

(No Model.)

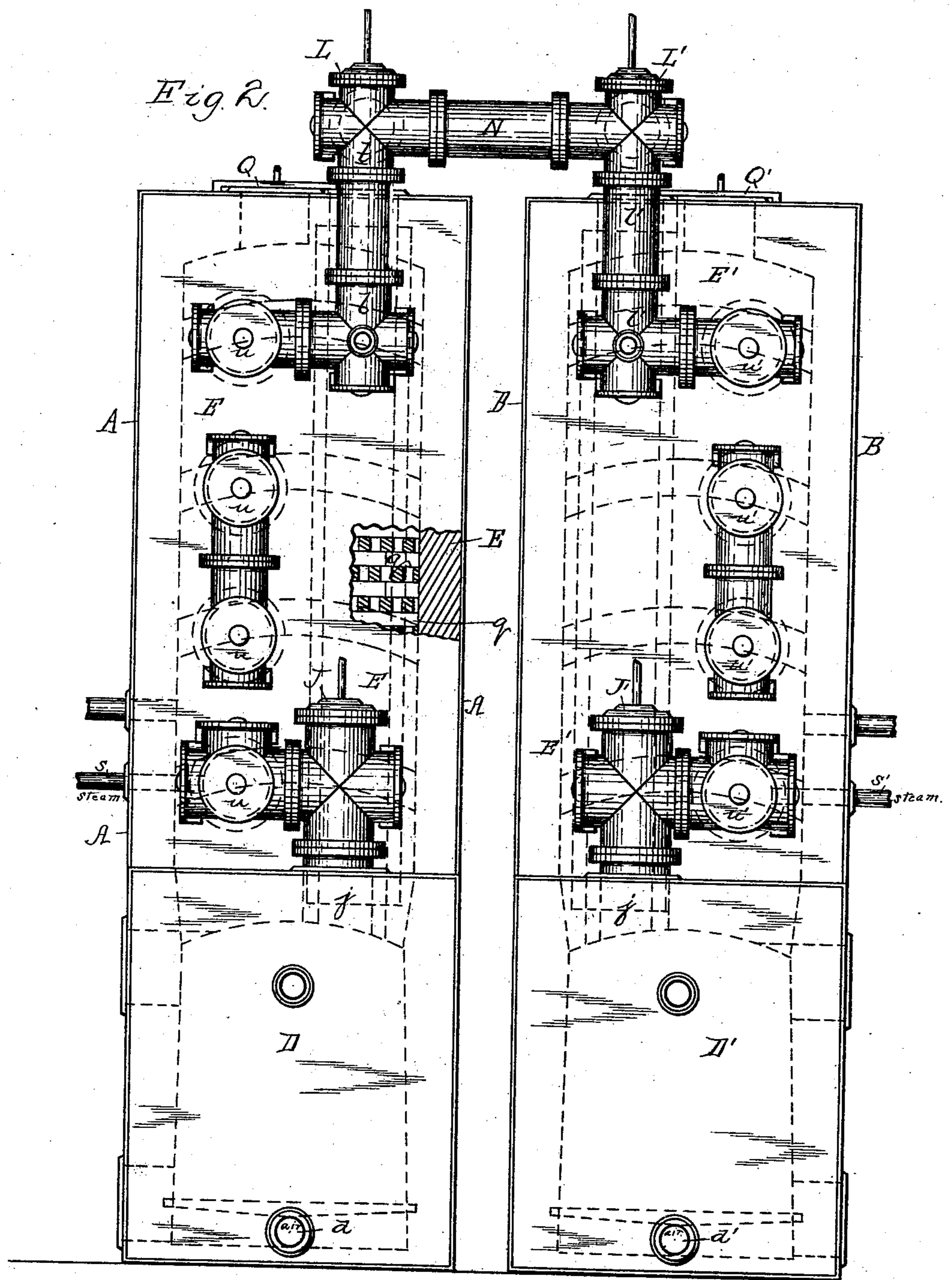
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J. M. ROSE.

APPARATUS FOR THE MANUFACTURE OF GAS.

No. 428,956.

Patented May 27, 1890..



Witnesses:
J. H. Coates
M. C. Varner

Inventor
James M. Rose
By James J. Ray
Attorney

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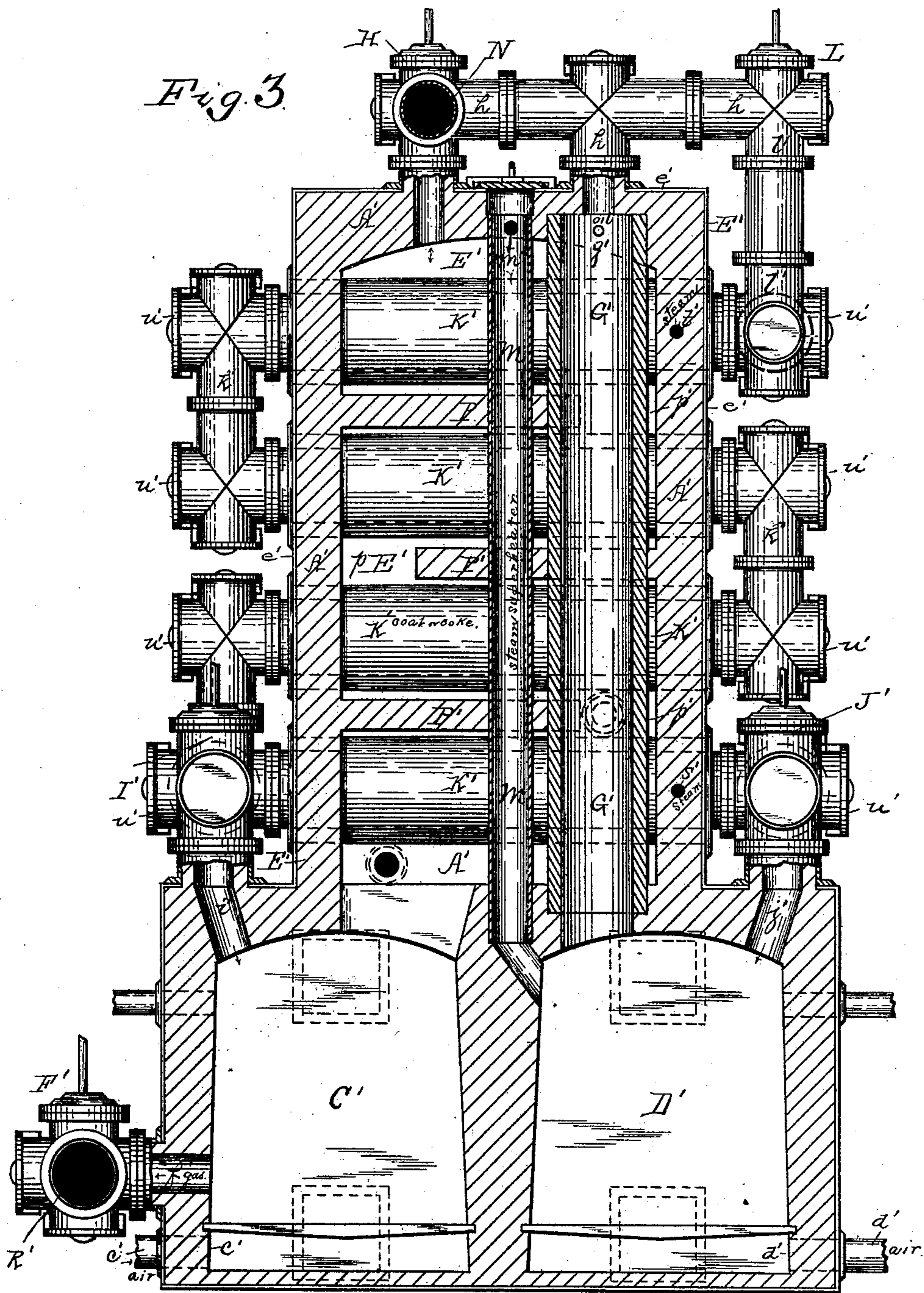
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UNITED STATES PATENT OFFICE.

JAMES M. ROSE, OF ALLEGHENY, PENNSYLVANIA.

APPARATUS FOR THE MANUFACTURE OF GAS.

SPECIFICATION forming part of Letters Patent No. 428,956, dated May 27, 1890.

Application filed June 10, 1889. Serial No. 313,708. (No model.)

To all whom it may concern:

Be it known that I, JAMES M. ROSE, a resident of Allegheny, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Apparatus for the Manufacture of Gas; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to the manufacture of gas, having special reference to apparatus for the manufacture of gas for fuel or heating purposes, though the apparatus may be employed, if desired, for making illuminating-gas and like purposes. Its object is to provide an apparatus in which a very large body of gases may be rapidly and continuously formed, and in which parts of the apparatus may be retained at the high heat necessary for such gas-making purposes, both for the superheating and decomposition of steam, the decomposition of hydrocarbons, and the fixing of the resultant gases.

My apparatus comprises two sets of gas-generating apparatus, which are preferably located and operated together, each such set having at the base thereof two cupola-generators, and above said generators a casing containing a heating-furnace or regenerator with which one of said generators communicates, and through which a series of horizontal retorts extend, said retorts being connected at the ends, and said heating-furnace having also a vertical cylinder passing through the same and communicating at the base thereof with the other cupola-generator, whereby the gases formed in one such generator may be burned within the heating-furnace to maintain the said retorts and vertical cylinder at a high heat, the retorts being employed for heating coal, coke, or other carbon contained in the same, through which steam is passed for the manufacture of water-gas, while hydrocarbons are introduced into said vertical cylinder, and, as will hereinafter be described, the gases formed, together with the further portions of steam, can be united and subsequently be fixed by a passage through the heating-furnace and through the body of incandescent carbon in one of the cupola-generators, all of which will be hereinafter more particularly described.

My improvements in connection with the

said apparatus will be specifically set forth in the claims.

To enable others skilled in the art to make and use my invention, I will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a plan view of my invention. Fig. 2 is an end view thereof. Fig. 3 is a longitudinal section on the line *x x*, Fig. 1.

Like letters of reference indicate like parts in each.

As above stated, I prefer to employ my invention with two sets of apparatus, one set being marked A and the other set B. Each set of apparatus has the same parts thereto, and I will first describe the set of apparatus marked A, the set of apparatus marked B being the same, and lettered the same, except that the letters are marked “” to distinguish them from those of the other set of apparatus in the description of the operation thereof. At the base of the apparatus are the cupola-generators C D, the cupola-generator C communicating through a port in the top thereof with the heating-furnace or generator E, which is built within a suitable plate-metal casing *e*, this casing and the furnace being preferably rectangular in shape, as shown.

The cupola-generator C has the air-entrance *c*, and has also suitable grate-bars and feeding and discharge doors, as is usual in the construction of such generators. It has also the eduction-pipe *f* leading therefrom near the base of the cupola and controlled by the valve F. The cupola D has the air-port *d*, and has like grate-bars and feeding and discharge doors. This cupola D communicates with the vertical cylinder G, which extends entirely through the heating-furnace and opens into a pipe *h* at the top thereof. Extending through the heating-furnace E are also one or more steam-superheating pipes M, each of which communicates at the base thereof with the cupola-generator D, and has at the upper end thereof suitable steam-entrance *m*, as shown. Extending through the heating-furnace E are a series of horizontal retorts or cylinders K, there being four such cylinders shown in the drawings, and these cylinders extending through the walls of the heating-furnace and communicating with each other at the ends—that is, the two upper cylinders having

their communicating pipe *k* shown at the left of the drawings, the middle cylinders having a like communicating pipe *k* at the right of the drawings, and the end cylinders having their communicating pipe *k* at the left of the drawings, these pipes therefore forming a continuous course from the top to the bottom of the series through which the steam may be passed, and the lower cylinder opening by suitable valve-controlled ports into the two cupola-generators C D, the opening *i* into the cupola-generator C being controlled by a valve L, and the opening *j* into the cupola-generator D being controlled by a valve J.

The upper cylinder communicates through a pipe *l* with the pipe *h*, said pipe being controlled by the valve L, and the pipe *h* communicates with the upper end of the furnace E through the valve H. Extending between the two sets of apparatus is the pipe N, through which the gases flow, as hereinafter described, in the making of the gas. The heating-furnace is provided with a series of arches, as at P, these arches being arranged in any suitable way so as to deflect the heat from one side to the other of the furnace, in order to provide for the proper heating of the retorts and cylinders therein, and being perforated on alternate sides, as at *p*, to permit the passage of the gases, and the spaces not occupied by the said retorts and pipes being filled with checker-work, as at *q*, so that practically all the heat from the burning of the gas therein is stored within said cylinders, the walls of the furnace, the arches, and the mass of checker-work serving to maintain a high heat within the retorts and chambers, so that the necessity for reversing at short intervals is overcome. Suitable air-ports are provided in the upper part of the cupola-generator C and at intervals in the heating-furnace E to provide for the complete combustion of the producer-gas employed in heating the same. The furnace has also the relief-valve Q, which can be opened while the gas is being burned within said surface for heating purposes, as above referred to. The eduction-pipe *f* communicates through the valve F with a pipe R, leading to the hydraulic main or storage-tank, this pipe R leading into both sets of apparatus, and also communicating with the eduction-pipe *f'* of the other set of apparatus through the valve F'. Suitable steam-pipes communicate with the series of retorts K—one steam-pipe *s* communicating with the lower retort and a like steam-pipe *t* communicating with the upper retort—so that steam can be fed in either course through said series of retorts. The said retorts are closed at their ends by any suitable removable caps, as at *u*, which may be clamped by any suitable means upon the ends of the retorts.

As above referred to, the parts in the set of apparatus marked B are the same as in the set marked A, and without referring particularly to each part it will be found that they are lettered the same, except that each

letter is marked with “,” the cupola-generators being C' D', the furnace E', vertical cylinder G', &c.

The operation of the apparatus is as follows: The several cupola-generators are filled with coal or coke, and the several retorts are filled with coal, coke, or charcoal, as may be desired. By means of the air-blast gas is generated in the several cupolas, the gases from the cupolas C C' being burned in the furnaces E E' and the gases formed in the cupolas D D' being burned in the vertical chambers G G'. When the apparatus is brought to the proper heat, the relief-valve Q of the heating-furnace E is closed, and the valve in the air-supply pipe *c* to the generator C is closed, while air is continued to the chamber D. Air is also shut off from the chamber D', but continued within the chamber C' of the other set of apparatus. The eduction-valve F, the valve H, the valve L in the first set of apparatus and the valve J' in the second set of apparatus are opened. All the other valves remain closed; and it may be here incidentally stated that the valves I and I' are not opened during gas-making, being only opened when the cylinders are being emptied of their carbonaceous materials. Steam is then admitted through the steam-inlet *t'*, which passes down through each successive retort K', passing through the furnace E', the steam being decomposed by the incandescent carbon within said retorts or cylinders, and then passing through the valve J' and passage *j'* into the cupola-generator D'. At the same time steam is admitted through the steam-entrance *m'* at the upper end of the vertical superheating-cylinder M', and in passing down through said cylinder the steam is highly superheated, and it also enters the cupola-generator D', being forced by its expansion down into the mass of incandescent coke contained therein, and being to some extent decomposed by said incandescent coke. At the same time oil is sprayed into the cylinder G' through the oil-entrance *g'* at the top thereof, and the water, gas and steam formed in the horizontal cylinders K' and passing from the superheater M' pass upwardly through this cylinder G', meeting the current of liquid hydrocarbons, which, as they descend through said cylinder against the current of gases are spread, the oil separating into drops, which are again divided into smaller globules or spray, and finally so intermingled with the gases rising through the cylinder that they are vaporized and unite with said gases, the gases then passing from the cylinder G' through the pipe N to the valve H, which is open, as above set forth, so that the gases can pass down into the heating-furnace or regenerator E. At the same time the air-blast in the cupola-generator D is continued, and the producer-gas passing upwardly through the cylinder G is intermingled with the superheated steam, which entered said generator from the superheating-cylinder M, the intermingled pro-

ducer-gas and steam rising through the cylinder G and against the current of liquid hydrocarbons introduced through the oil-entrance *g*, which descend against the current of gases, being intermingled therewith and finally united therewith, as described in an application for patent filed by me on the 14th day of March, 1889, Serial No. 303,313, and these gases also pass into the pipe *h*, intermingling with the other gases entering through the pipe N and passing downwardly through the regenerator E. At the same time steam is admitted through the pipe *s* at the lower end of the series of horizontal cylinders K, and this steam passes through the mass of incandescent carbon in the several cylinders and is decomposed, thereby forming water-gas, which passes through the pipe *l* and valve L into the pipe *h*, and thence through the valve H with the other gases into the regenerator E. All these gases are intermingled in this regenerator E, and they pass through the masses of checker-work between the several arches therein, and are properly heated and fixed in said regenerator or fixing-chamber, the gases then passing downwardly through the mass of incandescent carbon in the cupola-generator C, where they are rendered still more stable by the heat thereof, and any carbonic acid contained therein is converted into carbonic oxide, the gases then passing through the eduction-pipe *f* and valve F into the pipe R, and thence to the hydraulic main and tank.

I am thus enabled to obtain a large quantity of gas of high heating powers, the gas formed containing a large proportion of hydrogen and carbonic oxide, as well as a large proportion of marsh-gas or like hydrocarbon gases formed by the union of the hydrogen with the hydrocarbon, and the gas having little or no nitrogen, as but little of the producer-gas is employed, and the nitrogen introduced with the air is combined with the hydrogen in the presence of the steam and body of hydrocarbons, as described in an application filed by me October 4, 1888, Serial No. 287,148, and is consequently absorbed in the hydraulic main and eliminated from the gas. During this operation the producer-gas from the cupola-generator C' is passing into and burning in the heating-furnace or regenerator E', and a suitable quantity of air being fed thereto, so that a high heat is generated therein, and the several cylinders passing through the regenerator, together with the checker-work therein, are raised to a high heat and the said regenerator highly heated for the fixing of the gases on the reversal of the apparatus. The gases passing through this chamber are permitted to escape through the relief-valve Q', or, if desired, may be carried to the steam-generator and completely consumed.

On the reversal of the apparatus the gases pass in exactly the opposite direction, and the valves are reversed, as required, for the

purpose, the relief-valve Q' being closed and the relief-valve Q opened, the valves F, H, L, and J' being closed and the valves F', H', L', and J being opened, the air-blast being cut off from the cupola-generators D and C' and opened to the cupola-generators D' and C, the producer-gas from the cupola C being employed to again heat up the regenerator or furnace E. Steam is then admitted at the upper end of the series of horizontal retorts or cylinders K, and passing down through the incandescent carbon therein enters the cupola-generator D, steam being also admitted to the superheating-cylinder M, and passing down into said cupola-generator D, and the combined gases and steam rising through the cylinder G against the current of liquid hydrocarbons introduced therein. Steam is also continued to the superheater M', and passes down into the cupola-generator D', mingling with the producer-gas therefrom, and rising against the current of liquid hydrocarbon introduced into the cylinder G'. Steam is also introduced at the lower end of the series of retorts K', and passing upwardly through said retorts passes through the pipe *l'* and valve L', the gases all intermingling in the pipe *h'*, and passing through the valve H', through the heating-furnace E', and through the cupola-generator C' to the eduction-pipe *f'*, and through the valve F' to the pipe R. In this way it is seen that a high heat may be maintained in the entire apparatus proper for the generation of gases and the fixing of the same, and that a large body of water-gas may be formed and the gases properly intermingled with the liquid hydrocarbons, while the apparatus is compact in form and adapted to generate a very large body of gases. I am also enabled to utilize the heat obtained in the fixing-chambers for heating a series of retorts and decomposing steam and forming water-gas in said retorts and to maintain the heat in said series of retorts by the means of heated checker-work around the same, together with the direct combustion formed in one of such heating-furnaces around the retorts during the making of gas therein. In case of the distillation of tar or any such substances from the coal within such retorts means are provided for introducing the same into the cupola-generator below, where it can be broken up and formed into gases, direct communication being formed with such generators through the valves I I' and J J', though the mass of such materials would be taken up with the steam in passing through said body of carbon in the retorts.

If desired, one set of apparatus may be employed instead of the two sets, and the course of the gases through the same is practically indicated from the above description, the apparatus being heated up by the combustion of the gases formed in the cupola-generator C, and then the blast being turned off from the same and the gases passing from the series of retorts into the cupola-generator D,

thence through the vertical cylinder G, and thence down through the heating-furnace E and cupola-generator C to the eduction-pipe. In the use of the double apparatus in this way a continuous manufacture of gas can be carried on.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A gas-making apparatus having two cupola-generators and a heating-furnace or regenerator above the same, with which one of said cupola-generators communicates, a vertical cylinder communicating with the other generator and extending through the heating-furnace, a series of horizontal retorts or cylinders extending through the heating-furnace, and a pipe connecting said vertical cylinder and said series of horizontal cylinders, substantially as and for the purposes set forth.

2. A gas-making apparatus having two cupola-generators, a heating-furnace above the same, with which one of said cupola-generators communicates, a vertical cylinder communicating with the other cupola-generator and extending through the heating-furnace, a series of horizontal retorts communicating with each other and at the lower end with the second cupola-generator and having a steam-entrance at the upper end thereof, and a pipe connecting said vertical cylinder and said series of horizontal cylinders, substantially as and for the purposes set forth.

3. A gas-making apparatus having two cupola-generators, a heating-furnace above the same, with which one of said cupola-generators communicates, a vertical cylinder communicating with the other cupola-generator and extending through the heating-furnace, a series of horizontal retorts or cylinders extending through the heating-furnace, and a steam-superheating pipe extending through the heating-furnace, having a steam-entrance at its upper end and communicating at its lower end with a cupola-generator, substantially as and for the purpose set forth.

4. A gas-making apparatus having a cupola-generator, a heating-furnace above the same, with which said generator communicates, and a series of horizontal retorts passing through said heating-furnace and communicating with each other at their alternate ends, and also communicating at the lower end with said cupola-generator, substantially as and for the purposes set forth.

5. A gas-making apparatus having two cupola-generators, a heating-furnace above the same, with which one of said generators communicates, said furnace having a series of horizontal retorts extending through the same and communicating with each other, and communicating through a valve-controlled pipe with a pipe above said furnace, and having a vertical cylinder extending through said heating-furnace and communicating at the base with the other cupola-generator and at the top with said pipe above the heating-furnace, substantially as and for the purposes set forth.

6. A gas-making apparatus having two cupola-generators, a heating-furnace above the same, with which one of said generators communicates, said furnace having a series of horizontal retorts extending through the same and communicating with each other, and communicating through a valve-controlled pipe with a pipe above said furnace, and having a vertical cylinder extending through said heating-furnace and communicating at the base with the other cupola-generator and at the top with said pipe above the heating-surface, and a valve-controlled entrance from said pipe into the upper end of said heating-furnace, substantially as and for the purposes set forth.

7. In a gas-making apparatus the combination of two sets of apparatus each having two cupola-generators, a heating-furnace above the same, with which one of said cupola-generators communicates, a series of horizontal retorts or cylinders extending through the same and communicating with each other and with a pipe above the gas apparatus, a vertical cylinder passing through the furnace and communicating at its lower end with the other cupola-generator and at its upper end with the pipe above the gas apparatus, and a connecting-pipe between said two sets of apparatus, whereby the gases formed in one set may be carried into the other set for treating and a continuous gas operation obtained, substantially as and for the purposes set forth.

In testimony whereof I, the said JAMES M. ROSE, have hereunto set my hand.

JAMES M. ROSE.

Witnesses:

WM. P. MERCER,
B. W. HAINES.